Tactical Combat Casualty Care
October 2012

Direct from the Battlefield: TCCC Lessons Learned in Iraq and Afghanistan

TCCC Lessons Learned in Iraq and Afghanistan

- **Reports from Joint Trauma System (JTS) weekly Trauma Telecons – every Thursday morning**
  - **Worldwide telecon to discuss every serious casualty admitted to a Level III hospital from that w**
- **Published medical rep**
- **Armed Forces Medical Examiner's Office rep**
- **Feedback from doctors, corpsmen, medics, and PIs**


TACTICAL COMBAT CASUALTY CARE
PREHOSPITAL TRAUMA LIFE SUPPORT

Training

Fatal Extremity Hemorrhage

This casualty was wounded by an RPG explosion and sustained a traumatic amputation of the right forearm at the mid-forearm level and a right leg wound. He bled to death from his leg wound despite the placement of three field-expedient tourniquets.

<u>What could have saved him?</u>

C.A.T. Tourniquet

TCCC training for <u>all</u> unit members

***<u>Note: Medic killed at</u>**

Do Aviation Personnel Need TCCC?

In-Flight Tourniquet
24 June 2010

- AF Pave Hawk pilot on EVAC mission to pick up wounded UK soldier
- Gunshot wounds (GSW) both legs
- Severe bleeding R leg
- PJ crawled up into cockpit and applied tourniquet
- Bleeding controlled - pilot completed mission

Eliminating Preventable Death on the Battlefield

otwal et al – Archives of Surgery 2011

ll Rangers and docs trained in TCCC

anger preventable death incidence: 3%

.S. military preventable deaths: 24%

Forces
Savage et al: Can J Surg

Conclusion

For the first time in decades, the CF has been involved in a war in which its members have participated in sustained combat operations and have suffered increasingly severe injuries. Despite this, the CF experienced the highest casualty survival rate in history. Though this success is multifactorial, the determination and resolve of CF leadership to develop and deliver comprehensive, multileveled TCCC packages to soldiers and medics is a significant reason for that and has unquestionably saved the lives of Canadian, Coalition and Afghan Security Forces. Further-

Train ALL Combatants in TCCC

- **Service medical departments responsible for training combat medical personnel only**
- **Line commanders must take the lead to have an effective TCCC training program for all combatants**
- **Ranger Fi rse is the best mode**

Tourniquets

Tourniquet Studies
COL John Kragh USAISR

- **Get tourniquets on BEFORE the onset of shock**
  - **Mortality is very high if casualties are already in shock before tourniquet application**
- **If bleeding is not controlled and distal pulse is not eliminated with first tourniquet – use a <u>second</u> one proximal to first**
  - **Increasing the tourniquet W with a**

    second tourniquet controls

Tourniquet Studies COL John Kragh USAISR

- **Tighten velcro band on tourniquets as tight as possible before starting to use windlass – a loose velcro band contributes to tourniquet malfunction**
  - **Should be effective w**
    approximately thre
    degree turns of win
  - **Use second tourniqu**
    needed

Tourniquet Case Report Afghanistan – Nov 2009

- Soldier with gunshot wound to left leg
- Open fracture left femur
- Injury to popliteal artery and vein
- Three CAT tourniquets
  placed
- Life saved
- Leg doing well
- Multiple casualties
  week being saved w
  tourniquets

Preventable Near-Death Event from Tourniquet Issue

- JTS Trauma Telecon 12 July 2012
- Dismounted IED attack and GSW
- Severe bleeding right leg in popliteal region
- CAT applied – ineffective
- No second CAT applied initially
- Nearly bled to death from leg wound
- CPR being done on admission to MTF
- Second CAT placed at FOB – effective
- Massive transfusion – kidney failure – dialysis at WR

Counterfeit CAT Tourniquets

- **Fake CAT tourniquets that are prone to malfunction are turning up in theater – ensure that you have this NSN tourniquet:**
- **NSN 6515-01-521-7976**

Counterfeit CAT Tourniquets

DEFENSE LOGISTICS AGENCY
DEFENSE SUPPLY CENTER PHILADELPHIA
700 ROBBINS AVENUE
PHILADELPHIA, PENNSYLVANIA 19111-5092

IN REPLY REFER TO

DSCP-FSFB 10-150 April 14, 2010

MEMORANDUM FOR USAMMA, NAVMEDLOGCOM, AFMLO, MARCORSYSCOM, DMMPO

SUBJECT: QUALITY ASSURANCE URGENT PRODUCT SAFETY ALERT.

1. REFERENCES:

A. ITEM: Tourniquet, Nonpneumatic; C-A-Tourniquet®. NSN 6515-01-521-7976.
B. Item No(s): NAR-CAT, 30-0001 Serial/Lot No(s): N/A
C. Manufacturer: Composite Resources, Inc., 485 Lakeshore Parkway, Rock Hill, SC
D. Distributors:

North American Rescue Inc., 35 Tedwall Court, Greer, SC;
Cardinal Health, 1430 Waukegan Road, McGaw Park, IL;
Owens and Minor, 9120 Lockwood Blvd, Mechanicsville, VA;
American Purchasing Services (DBA American Medical Depot) 4380 NW 135th St, Opa Locka, FL;
Phoenix Textile Corporation, 21 Commerce Drive, O'Fallon, MO

E. Authorized for procurement through DoD Supply Chain Only.

2. SAFETY ALERT: CRITICAL LIFE-SAVING ITEM.

Order CATs from approved distributors!

Tourniquet on Uninjured Arm

- JTS Trauma Telecon 8 April 2010
- IED casualty
- Arrived at Kandahar with C-A-T in place on left arm
- Evaluation: no injuries sustained on left arm
- Follow-up: No explanation available
- Lessons Learned:
  - No injury = No tourniquet
  - Reassess, reassess, reassess

FEEDBACK TO THE FIELD (FT2F) #11:
Application of the Combat Application Tourniquet (CAT)

AFMES: COL H.T. Harcke, MC, USA

Lt Col E. Mazuchowski, MC, USAF

DMMPO: CDR T. Brunstetter, MSC, USN

Maj B. Ritter, BSC, USAF

C. Wasner, Program Analyst

S. Burrows, Biomedical Electronic Technician

REVIEWER: COL (Ret) J.F. Kragh, MC, USA

BACKGROUND:

- This study focuses on the *routing of the CAT friction band through its buckle*. The friction band can be routed through one slit or both slits of the buckle
  - Recommended routing depends upon: (1) *application* (one handed or two handed) and (2) *placement* of the tourniquet (upper or lower extremity)

BACKGROUND:

- Friction band routing through the CAT buckle: *3 possibilities…*

1 Slit (Inside)

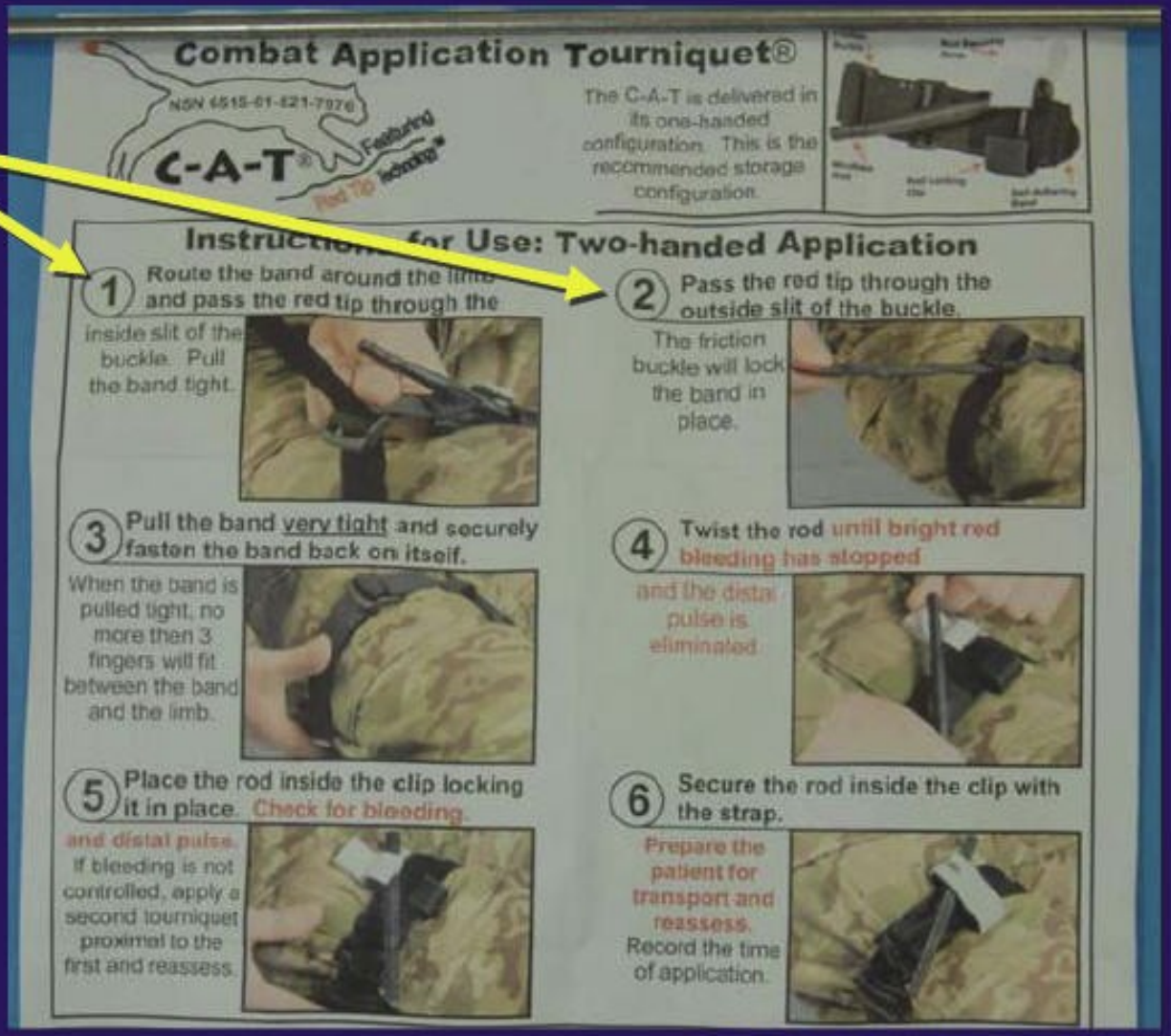
1 Slit (Outside)

2 Slits

BACKGROUND:

- Manufacturer ships the CAT with the friction band routed through one slit (Inside)
  - This is called the “ready to go” position

Double slit routing is used with two-handed applications



(CAT Packaging Insert)

Lower extremity applications should always have two slit routing.
Single slit routing is only acceptable in the upper extremities

CASE SERIES:

A review of 100 CAT placements evaluated the routing of the friction band through the buckle:

- 34 (34%) were upper extremity
- 66 (66%) were lower extremity

DOUBLE SLIT ROUTING:

- "Routing through both openings is indicated in lower extremity use…"
- "This double-routing also keeps the band from slipping when more torque is required in use on the thigh."

[Kragh, et al. *Mil Med*, 2011]

SUMMARY:

- Based on this sample of CAT usage, single slit routing was found in 23 of 66 (35%) of lower extremity applications

- In 7 of these 66 (11%) lower extremity applications, routing was through the outside slit, *preventing double slit use*

Double-slit routing for leg tourniquets!

Tourniquet Mistakes to Avoid!

- Not using one when you should
- Using a tourniquet for minimal bleeding
- Putting it on too proximally – place the TQ just above where the site of bleeding is!
- Not taking it off when indicated during TFC
- Taking it off when the casualty is in shock or has only a short transport time to the hospital
- Not making it tight enough – the tourniquet should eliminate the distal pulse
- Not using a second tourniquet if

** These lessons learned have been written in blood. **

Eye Injuries

Wear Your Eye Protection!

- Jan 2010
- 22 y/o near IED without eye protection
- Now blind in both eyes
- Don't let this happen to you

eye pro – eyes OK!

Without eye pro – both eyes l

Eye Armor – It Works!

Penetrating Eye Trauma

- **Rigid eye shield for obvious or suspected eye wounds - often not being done – SHIELD AND SHIP!**
- **Not doing this may cause permanent loss of vision – use a shield for any injury in or around the eye**
- **Eye shields not always in IFAKs**
- **o + facial njury!**

Shield after injury

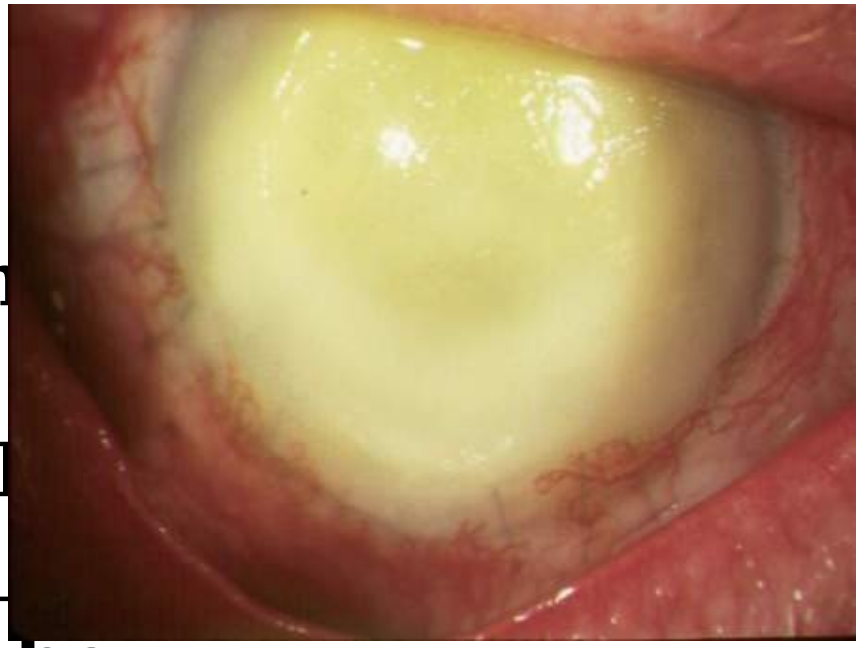
No shield after injury

Eye Protection

- **Use your tactical eyewear to cover the injured eye if you don’t have a shield.**
- **Using tactical eyewear in the field will generally prevent**

JTTS Trauma Telecon 9 Sept 2010

- **Recent case of endophthalmitis (blinding infection inside the eye)**
- **Reminder – shield and moxifloxacin in the field for penetrating eye pill pack!**
- **Also – need to contin moxi both topically systemically in the**
- **Many antibiotics do penetrate well into the**



Patched Open Globe 22 July 2010

- Shrapnel in right eye from IED
- Had rigid eye shield placed
- Reported as both pressure patched and as having a gauze pad placed under the eye shield without pressure – NO pressure patches on eye injuries
- Extruded uveal tissue (intraocular contents) noted at time of operative repair of globe
- Do not place gauze on injured eyes! COL Robb Mazzoli: Gauze can adhere to iris tissue and cause further extrusion when removed even if no pressure is applied

Pressure Dressings on Eye Injuries

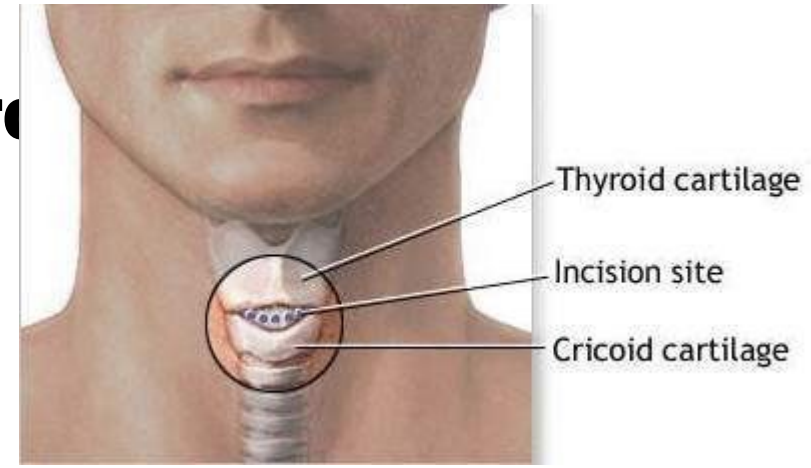
The <u>wrong</u> thing to do – makes a bad situation potentially much worse –


TACTICAL COMBAT CASUALTY CARE
PREHOSPITAL TRAUMA LIFE SUPPORT

Airways

Surgical Airways

- **Joint Trauma System e-mail of 24 September 09**
- **3 field crics done incorrectly in OIF**
- **One was done through the center of the thyroid cartilage and through one of the vocal cor**



Surgical Airways in Combat: The Rest of the Story

"The setting of the casualty care was at night in a non-permissive environment. The medic had sustained a sacral injury and damaged his NVG's during a hard landing on infil. The casualty had sustained a gunshot wound to the jaw. The medic was not called to the scene for ten minutes due to an ongoing firefight. The jaw was shattered and he had heavy maxillofacial bleeding. The recovery position was attempted repeatedly, but the casualty refused to remain like that. Anxiolysis was attempted with Versed to facilitate maintaining the airway with position alone, but did not work. The casualty became increasingly combative and the decision was made to perform the cric out of fear of completely losing the airway during evacuation. Due to the fact that the medic's NVGs were damaged, an operator (former 18D with two successful prior combat cric's) attempted the procedure with assistance by the medic. By then all landmarks had disappeared due to

Surgical Airways

Recommendations:

- **Live tissue training for this procedure if possible**
- **“Sim Man” trainer may be second-best option**
- **Don’t attempt a surgical air because the casualty is unco**
- **Try the “sit-up and lean forw position prior to attempting surgical airway if the casua is conscious**

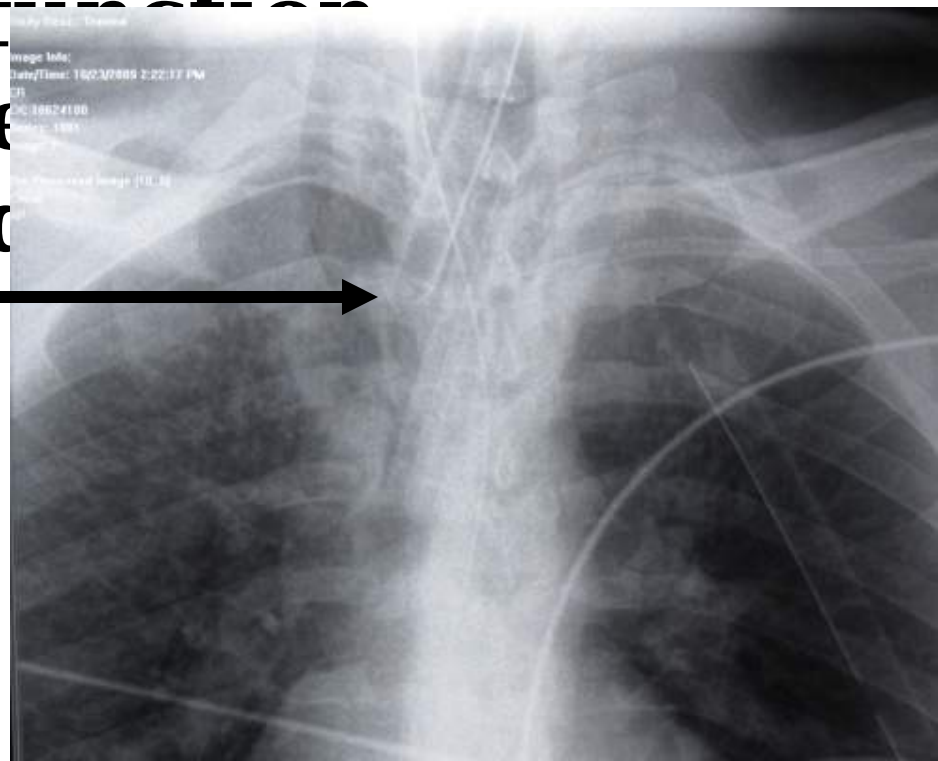
Surgical Airways

If you cut the endotracheal tube, you must tape it very securely or the tube will slip down into the trachea, cease to f

correctly, and have

surgically removed

Like this one….



Surgical Airways

- **Or – even better**
- **Use the <u>right tool for the job</u>**
- **A cuffed cric tube with tabs that prevent slippage**

Like this one…..

Surgical Airways

- **Be prepared for bleeding**
- **Have Combat Gauze at hand**
- **Vertical incision to reduce risk of bleeding**

FEEDBACK TO THE FIELD (FT2F):

CRICOTHYROTOMY OBSERVATIONS

AFMES: H T Harcke, COL, MC, USA

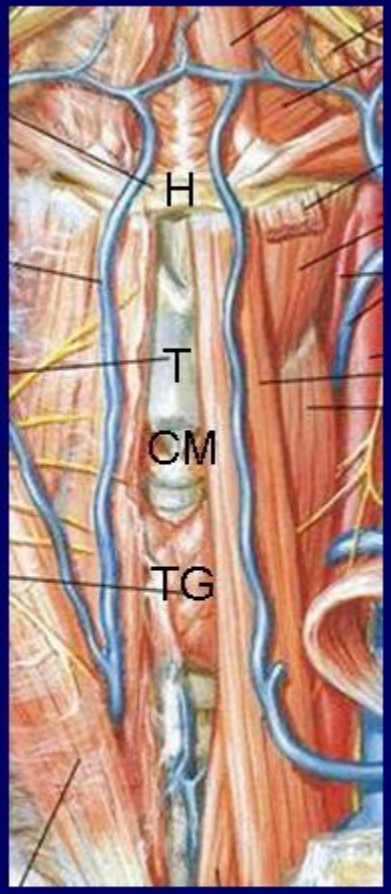
G Crawley, Lt Col, USAF, MC

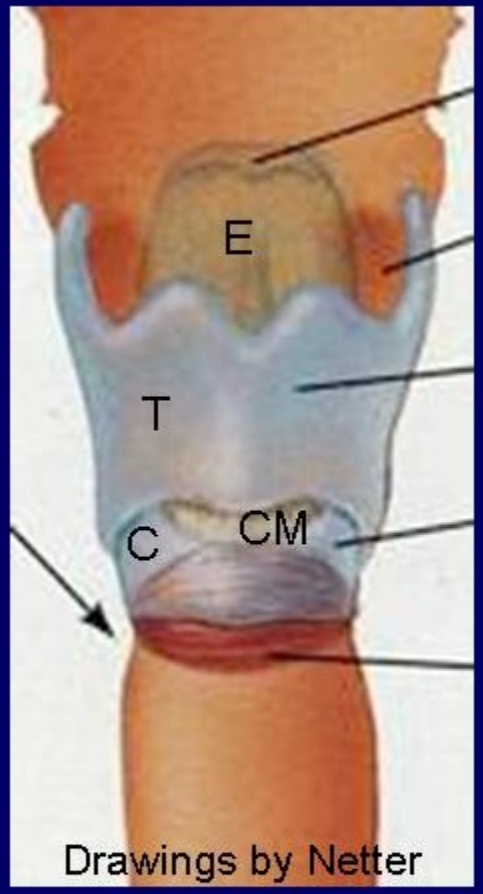
E Mazuchowski, Lt Col (Sel), USAF, MC

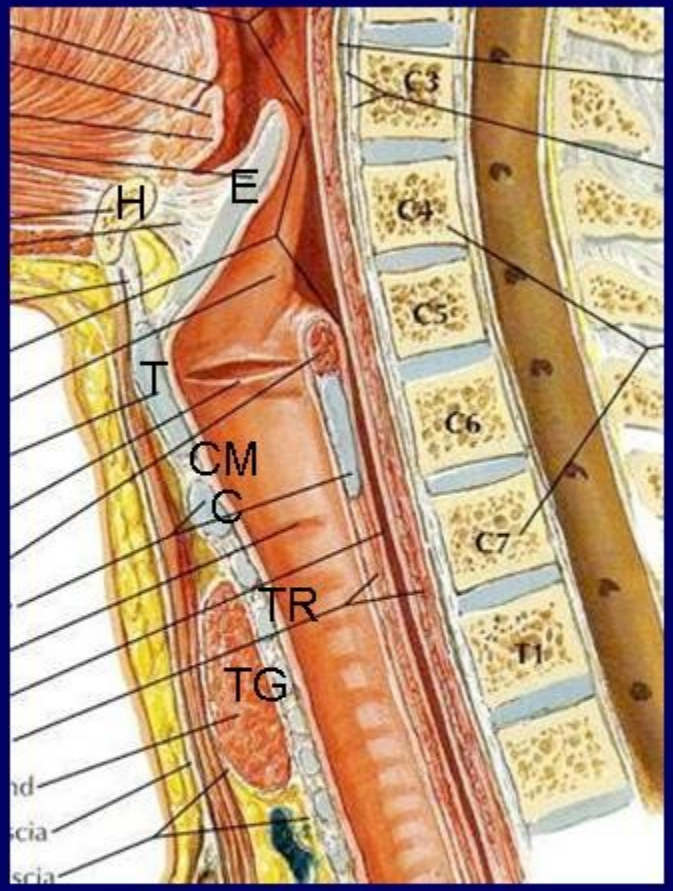
DMMPO: B Ritter, Maj, USAF, BSC, PA-C

C Shull, COL, DC, USA

OVERVIEW OF ANATOMY:







Key Anatomic Landmarks: Thyroid Cartilage (T), Cricoid Cartilage (C), Hyoid Bone (H), Cricothyroid Membrane (CM), Thyroid Gland (TG), Epiglottis (E), Trachea Rings (TR)

ILLUSTRATIVE CASE 6

King LT-D #4, 10 mm I.D.

Placed through neck wound above the CM - unclassifiable incision.

Tube entered the wound, passed directly into the esophagus.

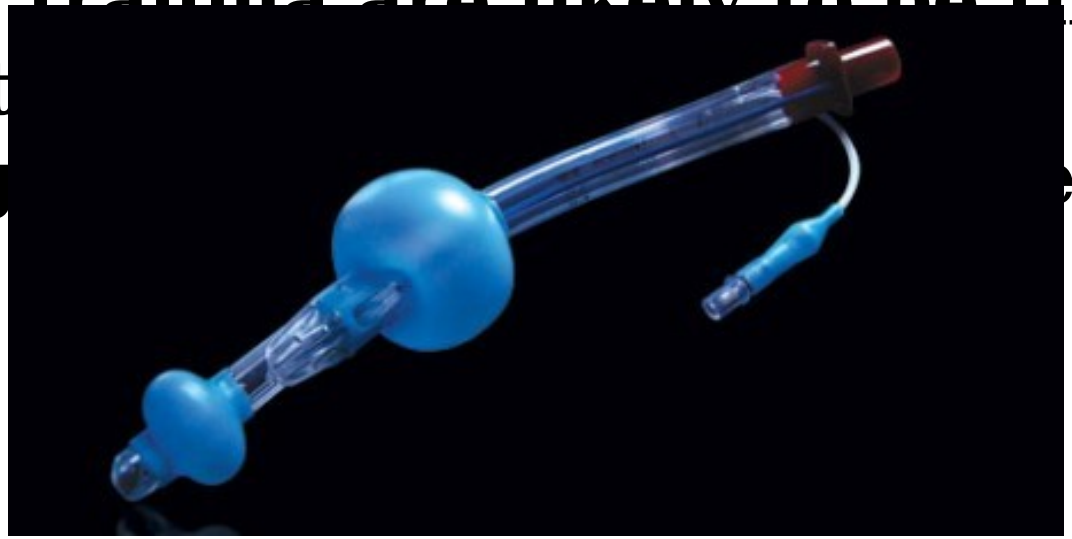
Airway Take-Home #1: Sit-Up and Lean Forward If Able

- **Many casualties with isolated maxillofacial injury can protect their airways by simply sitting up, leaning forward, spitting our the blood in their airway, and continuing to breathe in that position.**

- **This has saved multiple casualties discussed in the**

Airway Take-Home #2: Don't Force the Surgical Airway

- Casualties who are unconscious from hemorrhagic shock or severe TBI, but who have not suffered direct airway trauma are likely to be the best candidat
  suprag e King LT.



Airway Take-Home #3: Follow the Bubbles

JTS Trauma Telecon 2011

- Casualty with a gunshot wound to the neck
- Airway was obstructed with blood
- Medic noted air bubbles coming from the tracheal wound
- No need for an incision in this case – the medic put a cric tube directly into the trachea through the wound
- Held it there until the casualty got to a hospital
- Casualty did well - great save
- With penetrating neck wounds, follow

#4: Surgical Airway Technique

- Know your anatomy
- Dotted line at incision site during training
- Have the right tools for the job
- Supervised procedures before deployment – Live Tissue Training if possible
- Pulse ox in difficult airway casualties
- Reassess – Reassess – Reassess!

Spinal Precautions after IED Blasts

IED Casualties

- **IED blast casualties often have multiple mechanisms of injury**
  - **Blunt trauma**
  - **Penetrating trauma**
  - **Blast**
  - **Burns**
- **Majority of casua**

are now from IEDs

Comstock 2011 Journal of Trauma

ORIGINAL ARTICLE

Spinal Injuries After Improvised Explosive Device Incidents: Implications for Tactical Combat Casualty Care

Sean Comstock, MD, FRCSC, Dylan Pannell, MD, CCFP, PhD, Max Talbot, MD, FRCSC, Lisa Compton, RN, Nicholas Withers, MD, CCFP, and Homer C. Tien, MD, MSc, FRCSC

- **8% of IED casualties were found to have spinal fractures**
- **Almost half of these fractures were unstable and placed the casualty at risk for spinal cord injury**

IED Casualties

- **IED attack OR blunt trauma such as motor**

  vehicle crash with neck or back pain or

  unconscious – think spinal precautions

- **Try to maintain spi at all times**

- **C-collar AND spine board/litter applied**

IED Attacks

- **IED events – be alert for secondary IEDs or ground assaults after initiation of the IED**

Combat Gauze

JTS Trauma Telecon 26 Aug 2010

- 23 y/o male
- GSW left infraclavicular area with external hemorrhage
- “Progressive deterioration”
- External hemorrhage noted to increase as casualty resuscitated in ED
- No record of Combat Gauze use
- All injuries noted to be extrapleural
- Lesson learned: see following slide

Combat Gauze™

It doesn't work if you don't use it.

Combat Gauze™

Point of Emphasis:

If making a pressure dressing – <u>Combat Gauze</u> should be the first layer to

Intraosseous Devices

FEEDBACK TO THE FIELD:

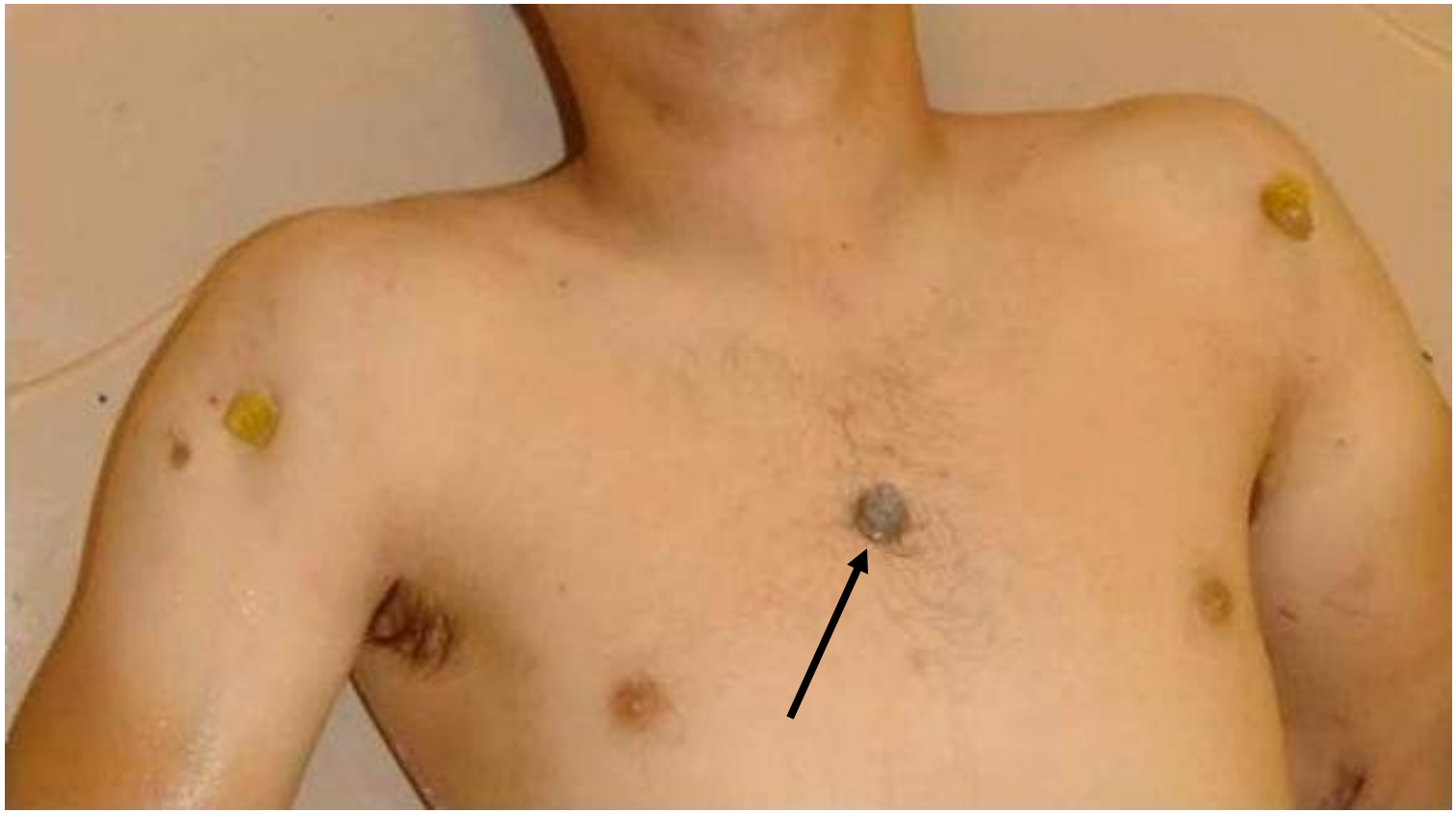
Perforation of the Sternum by an Intraosseous Infusion Device

H T Harcke, COL, MC, USA
Chief, Forensic Radiology
Armed Forces Institute of Pathology

E Mazuchowaski, Lt Col (Sel), USAF, MC
Deputy Medical Examiner
Office of the Armed Forces Medical Examiner

CASE OVERVIEW

- IED detonated in the decedent's vicinity.
- Catastrophic injury to the lower extremities and pelvis, to include traumatic amputation of the lower legs.
- Emergency treatment included tourniquets, sternal IO-IV, and proximal humeral IO-IV's.



Note sternal IO in place

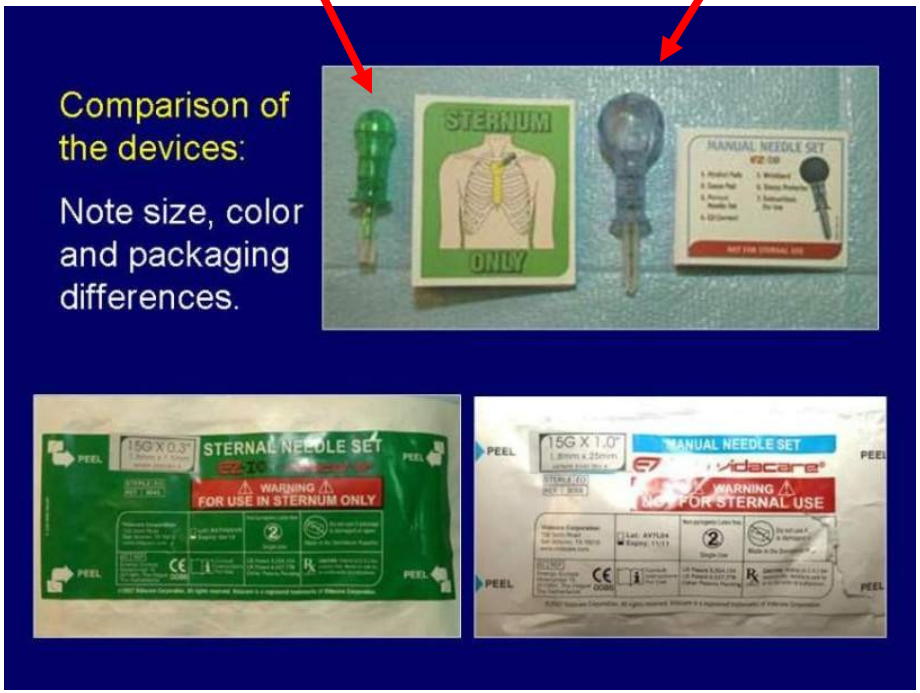
Autopsy CT Scan

Sagittal MDCT image shows the IO-IV needle passes through the sternum with the tip in the anterior mediastinum (arrow).

s is NOT where you want the infused fluids to g

IO Devices
Lessons Learned

Sternal IO **Extremity IO**



Do you really want to try to tell these two IO needles apart in the dark in a tactical mass casualty scenario?

Hypothermia Prevention Equipment

Ready Heat Skin Burns

- **Do <u>NOT</u> place the Ready-Heat Blanket directly on the skin - multiple reports of skin burns from this being done**
- **Keep T-shirt on**

Toxic Products of Combustion in Burning Vehicles

Possible Halon Exposure in a Combat Medic Presentation

- Ground vehicle convoy in Afghanistan
- Casualties inside vehicles during and after AFES discharge
  - "Smoldering" inside vehicle during casualty treatment
- Total time of exposure to fire suppression agent unknown
- Halon blamed for subsequent pulmonary sx in casualties and medic
- Halon off-gassing from casualties' clothing in helo?

What is "Halon"?

- **Halons are a group of chemical compounds consisting of hydrogen and carbon with linked halogens like bromine**
  - **There are many commercial halons with many uses, including fire suppression**
  - **Halon 1301 used in fire suppression systems in tactical vehicles phased out in mid-1990s**
- **HFC-227 is the new agent**

Toxic Byproducts of Combustion

- Fires in tactical vehicles can produce a variety of toxic byproducts:
  - Nitrous oxide, nitrous dioxide
  - Carbon monoxide, carbon dioxide
  - Hydrofluoric acid, hydrochloric acid, hydrogen cyanide
  - Acrolein, formaldehyde
- These are all pulmonary

Field Treatment for Smoke and Toxic Fume Inhalation

- **Prevent** by removing the casualty from the burning vehicle as quickly as possible
- Pulse oximetry monitoring
- Aggressive airway management
- Documentation of smoke exposure
- **Oxygen when available if oxygen saturation is low or if casualty is having respiratory difficulty**

Analgesia

NO Narcotic Analgesia for Casualties in Shock

- **Narcotics** (morphine and fentan
  CONTRAINDICATED for casua
  who are in shock or who are lik
  go into shock; these agents may worsen their shock and increase the risk of death
- Four casualties in two successive weekly telecons were noted to have gotten narcotics and were in shock during transport or on admission to the MTFs
- **Use ketamine for casualties who are in shock or at risk of going into shock but are still having significant pain**

Case Report September 2012

- Male casualty with GSW to thigh
- Bleeding controlled by tourniquet
- In shock – alert but hypotensive
- Severe pain from tourniquet
- Repeated pleas to PA to remove the tourniquet
- PA did not want to use opioids because of the shock
- Perfect candidate for ketamine analgesia

JTS Trauma Telecon 25 October 2012

- **Male casualty injured in dismounted IED attack**
- **Bilateral leg amputations**
- **Tourniquets applied to both legs by ground medic**
- **Bleeding initially controlled**
- **Casualty in shock (BP 72/46) with but 8/10 pain**
- **Given 100 mg ketamine – pain decreased to 2/10**
- **Flight medic reassessed casualty**

First – Do No Harm
Harris et al – Mil Med 2012

MILITARY MEDICINE, 177, 8:928, 2012

Self-Induced Bleeding Diathesis in Soldiers at a FOB in South Eastern Afghanistan

COL Melvyn Harris, MC USAR; MAJ Robert Baba, MS USAR;
LTC Richard Nahouraii, MC USAR; COL Peter Gould, AN USAR

urvey of 175 Soldiers at a FOB in SE Afghanist
Do you take over-the-counter or prescription
NSAIDs?"
f so, how often?

First – Do No Harm
Harris et al – Mil Med 2012

This survey exposes a previously unrecognized and undocumented near global use of NSAIDs on a military base located in a hostile zone in imminent danger. Over half of active duty soldiers surveys report daily consumption of NSAIDs that clearly is sufficient to put them at risk for coagulopathy. Combined with several times weekly use 75% of soldiers have a well-known risk factor for bleeding disorder nearly all the time.

First – Do No Harm
Harris et al – Mil Med 2012

CONCLUSION

The near global consumption of NSAIDs on a FOB located in a war zone presents a modifiable risk factor for compounding bleeding disorders in wounded soldiers. Although clinically inapparent without injury or sophisticated testing, NSAID-induced bleeding diathesis likely portends greater difficulty with DCR if the soldier should be significantly injured.

Recommendations:

- **Earlier platelets in DCR**
- **Consider restricting NSAIDs in theater**
- **Other analgesic choices: acetaminophen, cox-2 selective NSAIDs, tramadol**

Junctional Hemorrhage

JTS Trauma Telecon Dec 2011 IED Blast Injury

- **3 of 5 casualties had complex blast injuries**
- **None flown by MERT – reportedly flown by Dustoff – rapid transport to Level II**
- **All 3 with high traumatic LE amputations and reported difficulty with hemorrhage control despite tourniquet use**
- **Combat Gauze reportedly not used**
- **All 3 would have been CRoC candidates**
- **Reported prehospital care: no IV access; no blood products; no Hextend; no IO; no TXA**
- **2 of 3 required massive transfusion**

Combat Gauze™

It doesn’t work if you don’t use it.

Combat Ready Clamp

It doesn’t work if you don’t use it.

Tension Pneumothorax

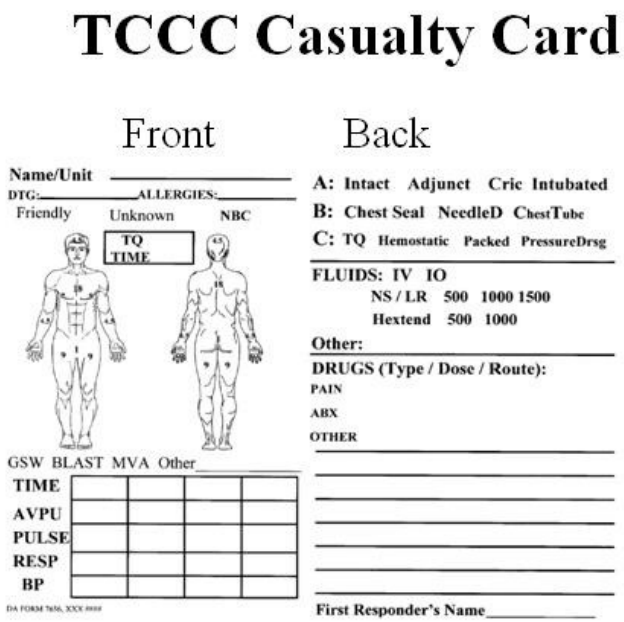
JTTS VTC 21 April 11

Tension Pneumo

- **19 y/o with GSW right chest (no body armor)**
- **Hypotensive in aircraft**
- **NDC done – improved - catheter left in but kinked**
- **Chest seal placed on exit wound in back**
- **Later found to have active bleeding from exit site chest seal saturated with blood – replaced with CG**
- **Hypotensive in ED**
- **Also had recurrence of tension pneumo**

Documentation of TCCC Care

TCCC Card – Fill It Out!



TCCC Casualty Card

Front

Name/Unit _____

DTG:_____ALLERGIES:_____

Friendly Unknown NBC

TQ TIME

GSW BLAST MVA Other_____

TIME				
AVPU				
PULSE				
RESP				
BP				

DA FORM 7656, XXX ????

Back

A: Intact Adjunct Cric Intubated

B: Chest Seal NeedleD ChestTube

C: TQ Hemostatic Packed PressureDrsg

FLUIDS: IV IO

NS / LR 500 1000 1500

Hextend 500 1000

Other: _____

DRUGS (Type / Dose / Route):

PAIN

ABX

OTHER

First Responder's Name_____

- **You're not done taking care of your casualty until this is done**
- **Mission Commanders – this is a <u>leadership</u> issue!**

Questions?

Backup Slides

Direct from the Battlefield

Additional Information on Halon

AFES Performance Criteria

PARAMETER	REQUIREMENT
Fire Suppression	Extinguish all flames without re-flash
Skin Burns	Less than second degree burns (<2400°F-sec over 10 seconds or heat flux < 3.9 cal/cm^2)
Overpressure	Less than 11.6 psi
Agent concentration	Not to exceed LOAEL*
Acid gasses	Less than 1,000 ppm peak
Oxygen levels	Not below 16%

* LOAEL – Lowest Observed Adverse Effects Level

From MEDCOM: Swanson, Dennis, "Fire Survivability Parameters for Combat Vehicle Crewmen," Department of the Army, Office of the Surgeon General, 20 February 1987.

US Army Ground Vehicle Crew Compartment Halon Replacement Program (U)

- HFC-227ea
  - Heptafluoropropane (CF3CHFCF3)
  - Ozone Depletion Potential = 0
  - LOAEL = 10.5% by volume.
  - NOAEL = 9% by volume.
  - Decomposes by reaction with high temperature (open flames, glowing metal surfaces, etc.) forming hydrofluoric acid, carbonyl fluorides, carbon monoxide and carbon dioxide.
  - Leaves no residue

Mike Clauson and Steve McCormick, US Army Tank-automotive and Armaments Command
AMSTA-TR-R / 263
Warren, MI 48397-5000
(810) 574-5948

ASSESSMENT OF THE FIRE SUPPRESSION MECHANICS FOR HFC-227ea COMBINED WITH $NaHCO^3$

Table 4. (U) Phase II (w/clutter) Baseline Test Data

Agent ‡	Total Weight (lbs.)	Bottle Config # x in^3	IR fire-out (msec)	Video fire-out (msec)	2-Min Ave HF (ppm)	Peak HF (ppm)
1301	9.9	3x144	777-1023	750-1000	2063	10348
1301	16	4x144	159-167	150-180	1789	3483
1301	12	4x144	179-193	180-220	1472	2031
1301	10	4x144	189-268	220-250	1086	1302
FM-200	16	4x144 §	172-216	180-240	844	1051
FM-200	12	4x144	185-220	190-260	1344	1636
FM-200 + BCS ✞	12+1	4x144	173-214	180-220	70	134

‡ - All tests used the 'standard' Army equipment bottles, valves and nozzles.

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Possible Fires in Tactical Vehicles

- Class A fires involving air filters, canvas, paper
- Class B hydrocarbon fuel fires fed by vehicle fuel, hydraulic fluid, lubricants, and miscellaneous materials such as paint
- Class C electrical fires including batteries
- Class D ammunition fires.